24P

NASA TECHNICAL TRANSLATION NASA TT F- 15,703

DEVELOPMENT POSSIBILITIES FOR TOPOGRAPHIC OVERVIEW MAPS (SCALE 1:500,000)

C. Hermann

Translation of "Entwicklungesmoeglichkeiten topographischer Uebersichskarten (am Beispiel des Massstabes 1:500 000)," Kartographische Machrichten, Vol. 23, No. 4, August 1973, pp 148-157 plus supplement

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON. D.C. 20546 MAY 1974

Development Possibilities for Topographical Overview Maps (Scale 1:500,000)

by: Christian Hermann, Zurich

The publishers of the different types of maps that are intended for the public are continually faced with the same multi-faceted problem: to create a map which enables the user to read quickly and completely understand the information that has been selected and entered on the map by the producer from his data without trouble to the extent possible; for it is also our objective to use the known mapping concepts and to find new mapping concepts in our maps, to inform the users about their environment, and to make the environment understandable to them.

At present there are new technical means available to the producer of maps for information which were not previously available: They can be used as the basis for new map concepts. If, for example, we think of the computer or of new type data, such as satellite photos, other scientific branches could influence future map concepts. Many questions occur to us: What can the cartographer work out together with the computer specialists? How can he graphically portray the interpretation of the smallest scale air and satellite photos. What type of suggestions will he receive, i.e. from the geography, climatology, geographical botany and other special environmental sciences? If we also stress individual map elements more than previously or even take up new elements, there is the possibility of re-establishing the accents of a map.

In the example of the topographic overview map 1:500,000 which is simply called TUK 500 is the following, we will now deal with these questions; for the scale 1:500,000 is not large enough to establish an adequate conceptual system for different questions but small enough for a worldwide adaptation.

As the oldest traditional topographic map concept, we are investigating the "brown" elevation relief maps. After that, the second traditional map concept is the Swiss Manier. It is a starting point for different excursions for us!

Starting from this point, we want to deal with the following in this sequence: the modified Swiss Manier, the natural topographical map, and also the use of the new types of data and auxilliary means. In between our own excursions, we will return to the Swiss Manier as our starting point. Traditional concepts of the TUK 500 are being investigated together with their modification possibilities and content expansions and presented as map probes.

Whether the development possibilities that are suggested by us will improve the previous information and shape of the TUK is the critical and most serious question which we must not let out of sight. The cartographer alone can not evaluate this. He controls the graphic side; however, for theshape of the content he is dependent on the cooperation of the neighboring sciences. With our various depictions we want to appeal to the neighboring sciences, including mapping to give increased attention to themselves as bearers of information.

When they announce their requirements, expanded concepts can be found in the scope of the topographic overview maps in an interdisciplinary teamwork. Since we never discuss map concepts without map examples, we are very thankful to be able to present a printed one[2].)

1. Traditional Map Concepts 1:500,000 for the Federal Republic of Germany

For seven years since H. Knorr (Knorr, H., 1966, Meine, K. H., 1965) presented the study of an official map 1:500,000 of the Federal Republic with four types of landscape extracts, no other attempts were undertaken at the federal level for economic reasons (Holzel, F., 1971). Therefore, only a few TUK 500s that are harmonized with each other have been produced in only some of the federal states. Since in the production of maps, they try to coordinate military and civilian requirement for economic reasons (the TK-200 is an incomprehensible example - in spite of all of the more or less plausible arguments), there was an initiative for a new national 1:500,000-initiative since the beginning of 1972. The Institute for Applied Geodesy (IfAG) in Frankfurt am Main produced the sheets 170-C Hamburg and 231-C Munich from the English Geo System. There are elevation relief maps without oblique shading with a large very open forest line raster. France has adapted the English 1404 series according to a new symbol key (see photo 1). It also contains a combination dusk and a modest forest point-raster.

Based on the French style, the IfAG is now also making the sheet 231-A Frankfurt am Main. The basis for the map work belongs to Great Britain which gave its approval for this experiment. It would certainly be hardly possible today to find a reproduction concept with the help of printing

experiments which would permit a better combination of forest, oblique shading and elevation relief: NATO, however, must be understandably concerned about the uniform designing of their map series. Thus the French 1404-version is the minimum that is achieveable in the scope of this standardization. So, the production of a traditional TUK 500 with the help of the federal military office might be solved within the given conditions.

2. Other Traditional Map Concepts 1:500,000: The Swiss Manier

The present trend with topographical overview maps is towards relief toned "Swiss Manier"[3]). They are the most complete traditional topographical maps.

In the Imhof relief maps, the situation elements are shaded with a detailed oblique light shading and with an aerial perspective and possible combined with modulated hysometric color tons. In 1965, Imhof, E. depicted the reproduction arrangement of the Swiss Manier and it was depicted in even more detail by Bantel, W. 1973, as they are attended to chiefly at the Art. Institute Orell Fussli Corp. Zurich. An example of this is the map of Switzerland 1:500,000, on which elevation curves-water-surface elements can be seen in figure 1 of the attachment in a 4-colored extract[4]).

---

1) For these map tests, Prof. Dr. H. Boesch helped and reported to me in the "natural-like" sector, Prof. Dr. H. Haefner, R. Gfeller and K. Itten helped and reported on the air and satellite photo sector, Dr. K. Brassel from the Geographical Institute of the University of Zurich in the field of automation, W. Bantel, K. Mayek (especially figure 8) and O. Puntener from the Art Institute Orell Fussli Corp., Zurich in the field of cartography.

2) Special thanks to the firm Art. Institute Orell Fussli Corp., Zurich which financed and printed the attached color prospectus!

Figure 7 and the background of the title page show the Relief-I-Sheet of the "Map of Switzerland 1:500,000". We recognize that in the Swiss Manier, the well arranged oblique light shading is important. Their high investment costs can be supported by the many uses of the oblique light shading.

But are these two traditional map concepts sufficient today? Isn't it about time to consider broader questions of the map users. There is a large number of subject maps. Subject maps can be integrated into the topographical overview map 1:500,000. Certainly, the military is still a primary customer for topographical overview maps. But the spectrum and the number of the remaining map users is increasing. For this reason, we are offering new variations in addition to the traditional concepts. With small mapping experiments, we would like to submit it to you here for discussion.

---

3) This also primarily includes the Imhof relief maps in addition to the official national maps of Switzerland.

4) If the relief is printed larger in the overall map, the maximum of a relief-accentuated Swiss Manier is achieved. The "Relief Map of Switzerland 1:500,000" by Jummerly & Frey, Bern and the official national map 1:500,000 by the Swiss National Topography (Landestopographie) are similiar. The successful attempt of Bollmann, J., (and H. Noth) in 1970 is also recalled.

3. Suggestion for a Modified Swiss Manier on a scale of 1:500,000 for other Climatic Regions

The visable photo of the earth's surface is determined by its form and its surface color tones. The mosiac only secondarily belongs to the covering elements which can appear very distorted on a scale of 1:500,000. If we would now want to forego the covering elements, then we could simply establish: The scale of 1:500,000 already requires such a degree of generalization that the depicting of the extracted, predominent color association of the covering elements is possible. These impressionistic colors are shown through elevation layers. Every climatic region shows typical color associations that are suitable for it alone (Ch. Herrman, 1972). The air perspective elevation layers of the Swiss Manier that are toned and possibly modulated are the typical "average" color association of the moderaly cool forest climate and their elevation variations. The Imhof relief maps, prepared in the Swiss Manier, agree very much with our climatic region (Imhof, E., 1965, page 380: "It is simply the landscape relief map.").

However, we would not have found an appropriate coloring if we declared the elevation layers-color association of our moderately cool climatic region to be bound to the agreement. Figure 3 (attachment) shows how we could modify the elevation layer colors of the Swiss Manier by climatic regions as is shown in the center extract and in figure 1. In the upper third of figure 3, an olive-gray-blue-scale with a cold effect was designed for the ice and tundra climate. In the lower third of figure 3, we show an olive brown-orange-yellow-white-scale with a warm effect for the moderately warm and tropical semi-desert and desert climates. With

these elevation layers of the Swiss Manier that are modified for climatic regions the hypsometric agreement that is too general can conform to the regional requirements. If we were to transform the Imhof color scale to this method, perhaps the Swiss Manier could break through to a greater degree. Also to be considered is that a sufficient number of trained relief specialists must be available.

Perhaps the requirement for topographical overview maps in other climatic regions, however, is so large that they could not take care of the content and graphical perfection of their maps; as for such countries the decisive point is more that a map is even produced. Everyone will recognize the advantage of a modified elevation layer scale that is arranged according to climatic region; however, we should always ask whether the variations from the intended useage of the maps are necessary in every case.

While the modified Swiss Manier for our region of the moderately cool forest climate would bring no change, the following suggestion is also somewhat new for the authorities who produce the topographical overview maps.

4. Suggestion for a Natural-Like Topographical Overview Map 1:500,000.

The heavily populated cities consume much land, the autobahns run across the otherwise still woods. Isn't it about time, to give increased consideration to the surface covering elements in a TUK 500? In 1972, the author (Hermann, Ch., 1972) investigated how they color the individual and predominently formal surface covering elements with their predominent color associations in each climatic region and how they combine them with a

oblique light shading. Figure 4 of the attachment shows the natural-like topographical overview maps 1:500,000 (TUK-500-nat) that results from this. Since figure 3 provides the same extracts, it can be seen that both types of maps are not contradictions. It is not the intent of this article to discuss the concept of the TUK 500-natural in detail (however, the TUL-500 natural has the best chance of the variations recommended here of becoming the map of the individual federal states for school instruction. The form and color of the covering elements are also shown in figure 4. In figure 3, the form of the covering elements is missing and their colors were abstracted; they are arranged by elevation. The impressionistic photo of fugure 3 can possibly have a didactically better effect than the confusing multi-colored areas mosaic of figure 4. In regard to the line elements, i.e. the situtation, the difference between both types of cards is very small; we will discuss the possible differences. In the TUK-500-natural, for method-didactic reasons, we must visbly arrange the incalcuable variations of the surface covering elements and thus generalize the content. Since in the previous natural-like map studies, there was only a conceptual system for the surface covering elements in pragmatically solved arrangements, the arrangement for a new world-wide functioning conceptual system was sought in Herman, Ch., 1972.

A possible conceptual system for area surface covering elements would consists of the vegetation used by humans (thus the current land use) and the current nautural vegetation. Also, the remaing areas that were not grown up and thus had no soil are shown as soil-type and non-soil type areas. These three parts of the system for which known classifications have been found are linked to an overall legend, and they are arranged by

climatic regions. For this, the simplified seasonal climates of C. Troll and K.H. Paffen, 1968 are best suited to the 13 climatic regions.

The settlements are also area type covering elements and must therefore be handled on an equal basis. Thus in place of the local markings that are staged according to population figures we are putting more local schemes and symbolic individual block markings in the TUK-500-hat. Figure 11 of the attachment shows the comparison of previous settlement representations 1:500,000 (above) with the changed settlement representation for the TUK-500-natural (below). In the case of the natural-like representation where the entire may area is provided with surface covering colors, these changes correspond to the entire concept. In traditional topographical overview maps 1:500,000 they can omit these settlement representations due to their high production costs and continual maintenance costs[5]).

On the enlarged NASA-ERTS-color transparent positives 1:500,00 is the MSS-volume 7, one cans see the settlements as light blue areas. Thus a compromise could be offered for the representation of settlements on a scale of 1:500,00: all light blue ERTS- local small markings, which are larger than a selected county marking, are entered as small markings. Only with a county marking will the smaller, but still visable small markings be distinguished. Symbolic individual block markings are missing.

Are the natural-like topographical map examples of figure 4 satisfactorily solved in regard to content and graphic portrayal? If the natural-like maps ate to be improved, then they should investigate to see whether so many surface covering elements should not be printed more transparent and with more distinguishable colors. They should also modify the surface colors.

In the light of the present environment discussion, it is sure that there is no future for these type of maps. Up until now, they could only set up landscapes by climatic regions from the TUK 500-natural on a world-wide basis[6]).

5. Possible Improvements in the Existing Topographical Overview Maps 1:500,000 through Satellite Photo Interpretation

The individual maps and map series that are offered world-wide on a scale of 1:500,000 show large quality differences between each other. As a subsequent map, the scale 1:500,000 is only as good as its large and medium scale basis. For example, if we only find illustration maps of a mountain country of the III world that have a surface covering and are on a scale of 1:200,000 or 1:500,000 and which have inexact elevation curves, then enlarged satellite photos expand our material basis on a scale of 1:500,00 very well. They provide us with a semi-toned photo which we interpret or which we can combine with the illustration elements of the traditional topographical overview map. There is also new information for scales smaller than 1:500,000 in addition to that for the scale of 1:500,000.

So, for example, the US-Geological Survey has mapped a photo mosaic on the original scale of 1: 138,000 with the U-2 at an altitude of 21.3 kilometers on the 1:250,000 sheet NI 12-7 Phoenix in June 1972. It can be compared to the same extract of the Experimental Edition from the year 1969 which contained an enlarged satellite photo taken from an altitude of 255 kilometers in addition to the traditional map-illustration elements. (U.S. Geological Survey, 1969, 1972). By August 1970, they had already tested the

same combination of satellite photos and map-illustration elements on a scale of 1:500,000 (U.S. Geological Survey, 1970).

Figures 9 and 10 of the attachment have been inspired by these experiments. Figure 10 shows the negative of an aerial photo mosaic which was taken on 18 December 1972 from an altitutde of 12 kilometers on a scale of 1:220,000. From the negative, we obtain the northwest illumination that is familiar to us. Due to the great distortions, we can only interpret the super wide-angle photo. There is much snow (gray and black in the negative), and valley fog spreads across the Walensee.

The mosaic was reduced to a scal of 1:500,000 so that the forest on the shaded side could be interpreted and mapped for figure 2 (very visable in the positive as black areas).

Since June 1972, the NASA-ERTS-1 satellite (Earth Resources Technology Satellite) has been revolving synchronous with the sun in a near Polar orbit at an altitude of 915 kilometers from earth (NASA-Data Users Handbook 1972). The scanner photo is 185 x 185 kilometers large on the earth's surface and is registered on scales of 1:3,369,000 or 1:1,000,000. From every field of view (IFOV) which is 79 x 79 meters large on the surface of the earth, the scanner stores a spectrally separate value which it

---

5) The problem of representing settlements for topographical overview maps was recently dealt with by Bollmann, J., 1970, Schulz, G. 1970, and by Neumann, J., 1972.

6) Bollmann, J. 1970 also provides a natural-like map example 1:500,000 from Salzburg and the surroundings which would be stimulating for a discussion about a TUK 500-natural of the Federal Republic of Germany.

selects from a scale of 63 stages. This value is then given a gray tone. The color transparent positive 1:1,000,000 from which figure 9 has been produced as a black-white negative enlarged to 1:500,000, is composed of 3 spectral areas. The visable greenish-yellow portion of the spectrum (500 - 600 nm) from the MSS-volume 4 is reproduced as a yellow portion. The visable red-orange part of the spectrum (600 - 700nm) from MSS-volume 5 is not mapped in red while the near IR (800-1100 nm) is colored in blue. The colored yellow, red and blue provides the many color compositions of the transparent positives 1:1,000,000. Thus in figures 9 and 10 we have entered different information on a scale of 1:500,000 in a very small frame.

If we now want to combine the black-white satellite photo negative directly with the traditional illustration map 1:500,000, this combination is less descriptive. Certainly, the negative shows the northwest illumination that we are used to and the compass is shown (see figure 2). Every rocky peak of the satellite photo appears to be suitable for the conventional TUK 500. But it is an arbitraty uniform illumination which does not deal with the detail clearly. However, if we rework the relief negative of the satellite photo instead of this illumination arbitrariness, then we see as in figure 8, that more model character can be given to the satellite-oblique light shading through slight illuminations, and drawing together, and reinforcing in the shadow with a small time expenditure. Of course, it must be insured that the catograph is in the picture as the relief appears in reality.

(inset photo 2 on bottom of page 153)

Photo 2: The satellite photo of figure 9 (attachment) and the guide for the "Map of Switzerland 1:500,000" of figure 1 suit each other exactly within the scope of this extract.

This method fails in the flatter areas. We cannot accent the small forms in this manner as is usual in the Swiss Manier. The comparison with the existing oblique light shading of figure 7 is interesting. With the help of these scanner photos the present shadings can also be reworked.

Figure 2 shows the combination of the traditional illustration map with the oblique light shading of figure 8. The relief in figure 2 appears flatter than in figure 1 because only a light gray was printed as relief L. The violet of the relief II was not produced. The forest was also mapped in the satellite color transparent positive 1:1,00,000 for figure 2 and enlarged to 1:500,000. On the large shadow sides, no forest interpretation was possible. The positive 1:500,000 helped there as we have reproduced it in figure 10 as an extract (only the negative). We see that the MSS-satellite photo is very useful for interpretation assistance for areas that lack good information and is also useable for combination possibilities (Kolb, O., 1973).

6. New TK 500-Concept Through-"Automated" Production Processes. The "Automated" production processes should understandably show the way to faster new production and continuation of the maps. Like every new production process, it will also change the map picture partially.

The first step towards automated maps is the changing of the computer, graphical map patterns into digital, numerical data with the help of the digitizer. Due to the presently available equipment, the point digitalizing and the digitalizing in line sewuence mode are given preference

over the scanning, that is the digitalizing in scan mode. That will change when raster plotters with high resolution are available to the public.

If we consider the TUK 500 not only as a subsequent scale but also want to include stored area information in data banks on a scale of 1:500,000, then the question arises whether we could not represent these area elements in rasters in our dissected landscape. The data bank of the Swiss, the Information Raster of the Local, Regional and National Planning Institute of the Swiss Technical College in Zurich, also registers area information in a 100 m raster (ORL-ETHZ, 1969-1972) in addition to the lined streets and railroads. They were 0.2 mm x 0.2 mm large raster squares on a scale of 1:500,000. The Minnesota Land Use Map of the Minnesota State Planning Agency which was published in 1972 shows us a useable subject map although raster information that could possibly be visually generalized in only printed on a tradtional base map.

Figure 5 of the attachments provides 0.6 mm x 0.66 mm large squares of the forest and fruit growing areas as a subject impression in two green tones. The natural 300 x 300 meter large use raster was separely printed by K. Brassel as a color cover approximately to scale as a 1/19 inch surface coverage raster on the IBM 1443 printer of the Zurich University Computer Center[7]). Unfortunately, we were not able to represent all the use units in figure 5. It is advantageous that the printed area raster can be partially evaluated quantitatively. The technical reproduction process also poses no great difficulties (see photo 3).

---

7) It is an arrangement. The areas are slightly distorted. The width of the display and the height of the line are retained at 36:35. For more detail see Brassel, K. 1971, 1973a, 1973b.

The 0.5 mm x 0.5 mm forest and fruit growing raster with natural landscape is 250 m x 250 m large in figure 6 (attachment). Here the user also has the impression of having subject map of the forest and fruit growing distribution that appears to be inexact. In contrast to figure 5, however, the automatic oblique light shading is used in place of the oblique light shading that is produced by hand. The natural 100 m x 100m large raster forms a printing raster of 50 on a scale of 1:500,00. This oblique shading was produced by K. Brassel on the IBM, K., 1973a, a way is offered that is more favorable from a cost standpoint. Since we only offer a visual generalization of the subject elements and all line elements also stem from the previous traditional TUK 500, they can only speak of automated attempts at subject maps in figure 6. Figures 5 and 6, however, have achieved their objective if raster covering subject impressions are accepted as a temporary solution.

The map concepts dealt with here were presented by a cartographer-geographer. Every specialist that was addressed, i.e. in the field of satellite photo interpretation or cartographic automation could now submit his thoughts for his area. It is hoped and expected; for only with cooperation between disciplines could they develop new information with the proper content and graphically balanced map concepts for topographical overview maps today. We offered two traditional topographical map concepts at the beginning of our consideration. Starting from this point, we scanned new concept variations in different directions. However, we encounter limitations everywhere. In order to overcome them, we need the help of the associated sciences.

(insert photos 3a, 3b, & 3c on page 155)

Photo 3: The technical reproduction rastering and thus the decrease of the printing ink color is also very possible in the case of surface elements. Photos 3a-c shows the forest-fruit cultivation areas of figure 5 (attachment) as 40% raster, 60% raster or full tone. The light green of figure 5 corresponds to photo 3c, the green of the forest also contains a 40% blue raster.

Results:

In addition to the traditional eleveation relief map 1:500,000, which will eventually be combined with the surface covering element forest, the graphic but remarkably structured relief accented maps in the Swiss Manier 1:500,000 that are also traditional were also presented. A greater distribution can be achieved for the Swiss Manier through the Modification of their Hysometric Scales by climatic region. In light of the present -- discussion regarding the environment, a view of the surface area covering elements in an expanded natural-like topographical overview may 1:500,000 should be considered for schools. For regions that were previously badly measured, the Combination of the Illustration Map 1:500,000 with the interpreted MSS-Satellite photo is recommended. The present status of automation permits the use of the Impression Raster Subject Information on topographical base maps 1:500,000 as a temporary solution. However, without inter-disciplinary cooperation of all the branches involved, no new concepts could be found for topographical overview maps.

Literature Listing:

Bantel, W. (1973): The Reproduction Process from the Singel Colored Relief Original to the Multi-Colored Relief Map, International Yearbook for Cartography XIII, Gutersloh.

Bollmann, J. (1970): Experiment on a Overview Map on a scale of 1:500,000 Carbographic News, 20th Year, 6, pages 224-230.

Brassel, K.(1971): Representation Experiments with the Data Controlled Fast Printer, Cartographer News, 21st Year, 5 pages 182-188.

Brassel, K. (1973a): Model and Experiment for Automatic Oblique Light Shading, Diss. University Zürich.

Brassel, K. (1973b): Singe and Multi-Colored Printer Representations, Cartographic News, 23rd Year, 5 (being printed[8]).

Herrmann, Ch. (1972): Study on a Natural-Like Topographical Map 1:500,00, diss. University of Zurich.

Holzel, F. (1971): Where is the Topographical Overview Map 1:500,000? Cartographic News, 21st Year, 3 pages 91-93.

Imhof, E. (1965): Cartographic Terrain Representation, Berlin

Knorr, H. (1966): Study of an Official Map on a scale of 1:500,000, German Geodetic Commission, Series B, Nr. 131, Frankfurt am Main

Kolbl, O. (1973): Combined Evaluation of Satellite and Aerial Photos for Topographical Mapping, German Geodetic Commission, Series C, Diss, Book Nr. 188, Munich.

Meine, K. H. (1965): Before a Concentrration of the Official Scale Series?, Periodical for Measurement, 90th Year, Nr. 12, pages 507-509.

NASA-ERTS-Handbook (1972): Data Users Handbook, Earth Resources Technology Satellite, Goddard Space Flight Center, Greenbelt, Maryland, Nationa Aeronautics and Space Administration.

Neumann, J. (1972): Where is the Scale Limit Between Topographical and Chorographic Maps? Cartographic News, 22nd Year, 3, pages 107-110.

Nuesch, D (1972): Natural-like Map of the Zurich Canton 1:150,000, not published, Certified Work, Geographic Institute University of Zurich.

ORL-ETHZ (1969-1972): Institute for Regional and National Planning ETHZ, Work Reports for the Local, Regional, and National Planning, Information Raster 1/2: Overview and Preparation Work, 3: Characteristics and Characteristic Relationships, 4: Data Photo of Land Maps with hole tape equipment, 5: Data Photo of Land Maps with a Digitizer, 8: Comprehensive Representation of the Results and Applied Methods, Zurich.

Schulz, G. (1970): Representation Questions of the Map Scale 1:1,000,000, Cartographic Miniatures 3, Berlin.

US-Geological Survey (1969): 1:250,000 Scale Space Photomaps (Experimental Edition), United States Department of Interior, 1971.

US-Geological Survey (1970): 1:500,000 Scale Space Photomaps (Experimental Edition), United States Department of Interior, August 1970.

US-Geological Survey (1972): Experimental Ortho-photoquad from U-2 Photographs,

Phoenix, Arizona, 1:250,000 - Scale Quadrange, June 1972.

---

8) The Article, which contains references to this article was not able to be published in this edition 4/73 for organization reasons.

Ch. Herrmann, Zurich

POSSIBILITIES FOR DEVELOPING TOPOGRAPHIC OVERVIEW MAPS

Scale 1:500000

22d Meeting of the German Cartographers

Munich 1973

This color supplement was donated by:

Art. Institut Orell Fuessli AG
8022 Zuerich
Dietzingerstrasse 3
Switzerland

Color supplement to the:
Kartographische Nachrichten, Vol 23,
~~Cartographic News Report~~ No. 4/1973

Figure 1:* Swiss Relief in Scale 1:500,000 - "Map of Switzerland 1:500,000," Art. Institut Orell Fuessli AG, 1971. Water, elevation curves, hypsometric scales and oblique light shading are depicted by four colors on the extract. (Surface coloring on the original map depicts the local markings for the most important economic structure of the area.) Canton Glarus, south of Lake Walen (Switzerland).

Figure 2: Combination Illustrated Map 1:500,000 - Satellite Picture, The line elements of the "Map of Switzerland 1:500,000," Art. Institut Orell Fuessli AG (situation, rivers, railroads, elevation curves) was combined with the reworked oblique light shading satellite photo from Figure 8 and the sections of forest interpretated from Figure 9 (satellite photo) and Figure 10 (aerial photo mosaic). Canton Glarus, south of Lake Walen (Switzerland).

* Translator's Note: Figures I - II are not reproducible.

Figures I-II not included in this report

Figure 3: Modified Swiss Relief in Scale 1:500,000. If we only consider the modulated hypsometric colors of the Swiss relief (central section) as a prominent color association of the relatively cool forest climate, then we have to design independent hypsometric scales for all the other climatic regions. For example, for the ice and tundra climatic region in the upper part and for the lower region which is tropical and has a desert and semi desert-like climate. The extracts correspond to those in Figure 4.

Figure 4: A Natural Type Topographical Map 1:500,000. In addition to the situation, the relief and the surface elements are depicted in equal proportion. The latter are arranged by climatic regions in the system elements (current land use, natural current vegetation, soil and soil-free surfaces) and depicted by their predominent color association. The upper part shows the ice and tundra climate at Spitzbergen, the center one show the cool forest climate of Sapporo (Japan), the lower one shows the tropical and warm semi-desert and desert climate at El Hadjira (Algeria). For more details, see Ch Hermann, 1972.

Figure 5: Combination of the Traditional Base Map 1:500,000 with the Automated Subject Impressions.
The line elements (situation, rivers, railroads, elevation curves) and the oblique shading of the "Map of Switzerland 1:500,000," Art. Institut Orell Fuessli Corp. was combined with computerized surface elements. The natural 300 x - 300 m raster shows the forest and fruit cultivation area and was compiled by D. Nuesch in 1972 from aerial photographs. Depiction is on the IBM 1443 printer with special markings by K. Brassel. Canton Schwyz, south of the Lake of Zurich (Switzerland).

Figure 6: "Fully Automatic" Topographical Maps 1:500,000: An automatic oblique shading by K. Brassel was combined with cimputerized surface elements. The oblique shading is printer original reduced 13.5 times which has a 100 m raster. The natural 250 x 250 m natural forest and grape growing rasters were taken from the land map 1:50,000, sheet 272, St. Maurice (Switzerland). Depiction on the Printer IBM 1443 with special markings by K. Brassel. Due to the simplicity, the line elements are not digitalized and automatically engraved, but they are taken from the "Map of Switzerland 1:500,000," Art. Institut Orell Fuessli Corp., Canton Wallis, Dent-de-Morcles (Switzerland).

Figure 7: Oblique Shading for the Swiss Relief on a scale of 1:500,000: Indicated with a pencil, indian ink and brush on an elevation curve-water-iron blue copy: the levels are inserted. The relief II (violett) is also produced from the same original (W. Bantel, 1973). Extract from the relief I (gray) of the "Map of Switzerland 1:500,000", Art. Institut Orell Fuessli Corp., 1971 (see Figure 1). Canton Glarus, south of Lake Walen (Switzerland).

Figure 8: Oblique Shading according to the MSS Satellite Photo. The negative paper proof sheet of the MSS Satellite photo of Figure 9 has been exposed so that there is no more shade on the sunny side. Also touched with india ink, brush and partially inserted: photo with 70 rasters. Canton Glarus, south of Lake Walen (Switzerland).

Figure 9: ERTS-1-MSS-Satellite Photo 1:500,000 (Negative: Combining of MSS-volumes 4, 5, and 7, that means spectral ranges 500-600 nautical miles, 600-700 nautical miles, 800-1100 nautical miles; enlarged 6.75 times). Taken at 10:55 hours on 7 October 1972 from an altitude of about 915 kilometers: Sun elevation 33 degrees; sun azimuth 154 degrees. Data transmission in digitalized form (Photo: NASA/Goddard Space Flight Center, Greenbelt, Maryland, USA) reproduced in 70 rasters. The orange-brown forest texture can be seen especially well on the sunny side on the color transparent positive 1:1,000,000.) Canton Glarus, south of Lake Walen (Switzerland).

Figure 10: Mosaic Aerial Photograph 1:500,000 (Extract, like Figure 9, left half is a black and white negative, super wide-angle photo, focal length f - 44 mm; 2.3 reduction. Taken on 18 Dec. 1972 from an altitude of 12 kilometers. Reproduced in 70 rasters. The forest areas (white in the negative) are also very visable on the shaded side. Canton Glarus, south of Lake Walen (Switzerland). Reproduced by permission of the aerial reconnaissance service in Dubendorf (Switzerland) on 31 May 1973.

Figure 11: The Depiction of the Situation in the traditional topographical overview maps 1:500,000 (upper part: "Maps of Switzerland 1:500,000", Art. Institut Orell Fuessli Corp.). As a comparison, the settled areas from MSS-Volume 7 of the satellite photo of Figure 9 are entered as complete areas (previously village outskirts were left open). In the lower part, the depiction of the situation is shown for the natural topographical maps 1:500,000. Canton Glarus, south of Lake Walen (Switzerland).